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The Unification of Hydro-Electric Development in Central Japan

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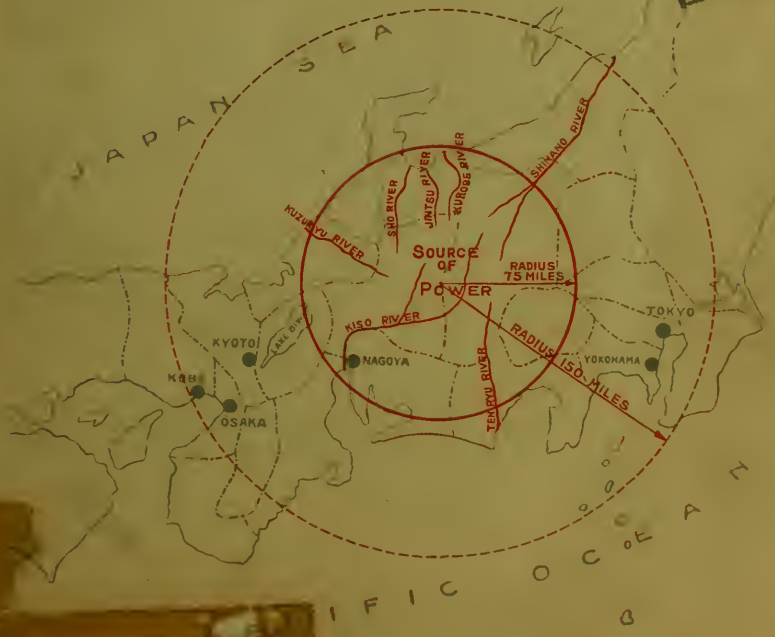

THE
DAIDO ELECTRIC POWER CO LTD
TOKYO JAPAN

October 1922

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The upper part of the Kiso River

大正戊午六月 公望

利穿金石功濟天下

"Its sharpness piercing adamantine

Beneficence delivereth the world."

Translated by Yone Noguchi.

The above verse, translated as nearly as possible from the Japanesee, written in honor of Mr. M. Fukuzawa, President of the Daido Electric Power Co., by Prince Saionji, a former Premier of Japan, is carved on a stone gate above the head tank of Shizumo Power Plant.

ILLUSTRATED DIAGRAM OF ENTERPRISES
PLANED BY
DAIDO ELECTRIC POWER CO., LTD.

Road constructed for carrying supplies and materials to Momoyama Power Plant

Mt. Ontake in Central Japan Alps is over 10,000 feet high. It stands near the source of the Kiso River Ref. Map II

MAP I

MAIN ISLAND OF JAPAN

Rivers Marked with Red are Source of Power in Central Japan.

The Tail-race discharging into the Kiso River seen from Momoyama Power House.
In the background is shown the Intake of Suhara Plant

I

CENTER OF HYDRO-ELECTRIC POWER RESOURCES IN JAPAN

(Ref. Map I & II)

THE economic situation surrounding the natural fuel resources of Japan in relation to the present and future industrial expansion along manufacturing lines—the question of fuel reserves, the rise and increasing difficulty of labor problems, combined—give the essential factors which have resulted in the remarkable progress made in the past few years in hydro-electric development. In the more than three thousand miles of the mainland extending from north to south there are many rivers having suitable gradients for hydro-electric development, and the rainfall which is evenly distributed over the whole country assures a regular supply of energy in these streams. Moreover the national practice of forest conservancy carried out since Feudal times assures the sources and guarantees

with the passing of time further and further improvements in their run-off and control. It is therefore only natural that these factors should quicken a rise of significant hydro-electric power development which must be considered to be nothing but an execution of the economic state policy carried out by the "Country of Rivers."

The central portion of the mainland, the heart of Japan, has many rivers of sharp gradient rising in the plateau of the so-called "Japan Alps." These rivers are so advantageously situated with reference to the demand for electrical energy of large cities and towns that they naturally select themselves for primary consideration in the development of hydro-electric energy.

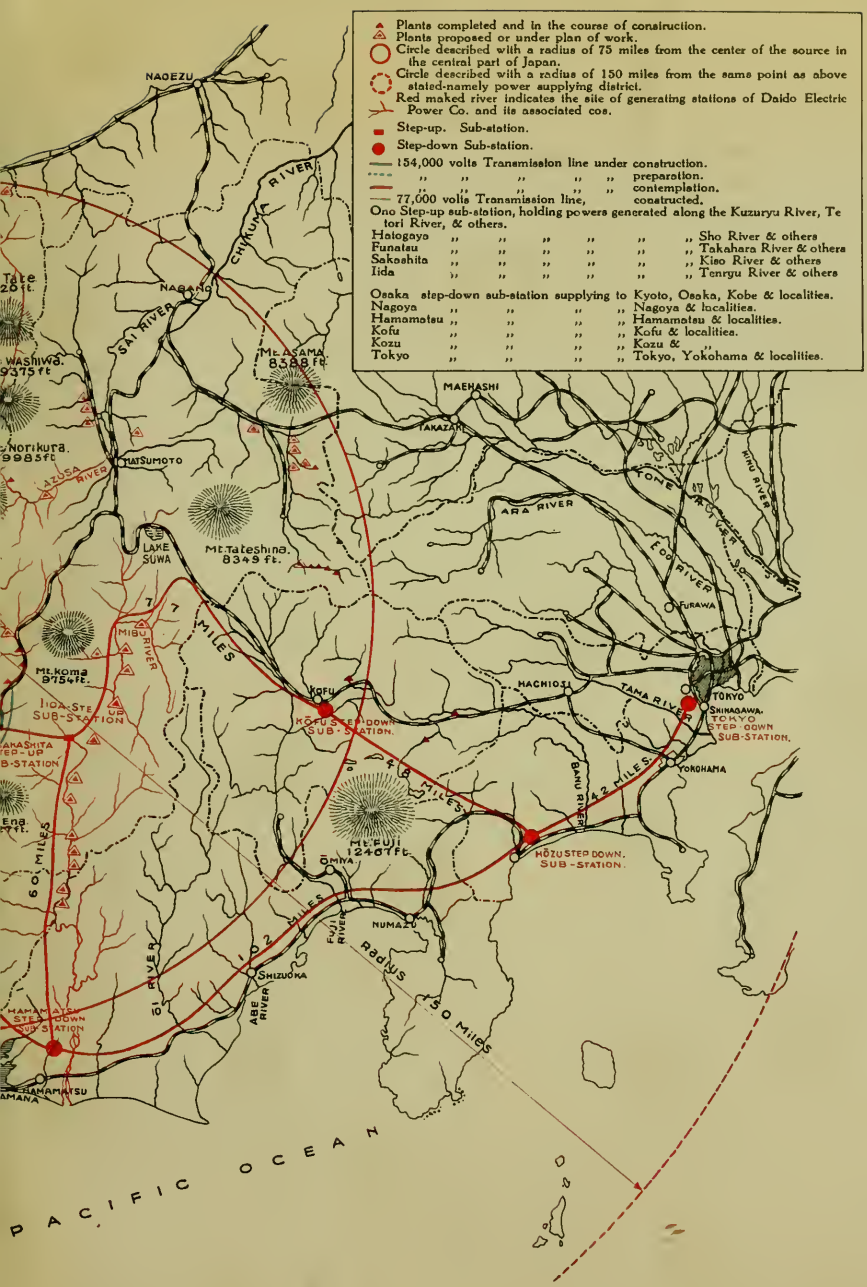
Suppose we describe a circle of 75 miles radius with the center at Mount Ontake, 75 miles northeast from Nagoya, the circle embraces the central portion of the mainland including all the important rivers and basins capable of hydro-electric development. This is the reason why we call this portion of the mainland the "Source of Hydro-Electric Power in Japan." This source of power development stands close to the principal power markets of the country, and a circle having the same point as a center but of 150 miles radius which is easily within the present transmission distances includes practically all the more important centers of power demand. Thus, on the east we have Tokyo, the capital of Japan, Yokohama and their surrounding districts, on the south Nagoya, Hamamatsu, Yokkaichi, Gifu, Toyohashi, Shizuoka, Nara and their environs, on the west Osaka, "The Manchester of Japan," Kyoto, Kobe and their localities. It will therefore be noted that most of the great cities and towns of the country are included within this circle which could be aptly termed the industrial sphere of Japan.

The Daido Electric Power Co. together with its associated companies under the able leadership of President Fukuzawa has for its purpose and considers it a duty to develop and make available to the principal centers of our country this vast source of potential and lasting wealth to the end that our growing industries may prosper and compete successfully in the markets of the world.

MAP II

POWER SOURCES
AND
PROPOSED TRANSMISSION SYSTEM
DESIGNED BY
DAIDO ELECTRIC POWER CO., LTD.

TOTAL OUT-PUT GENERATED BY POWER PLANTS —640,000 K.W. (APPROX.)
TOTAL ,, ,, ,, ,, STEP-DOWN SUB-STATIONS—560,000 K.W. (,,)
TOTAL LENGTH OF TRANSMISSION LINES. — 1,100 MILES (,,)


Plants completed and in the course of construction.
Plants proposed or under plan of work.
Circle described with a radius of 75 miles from the center of the source in the central part of Japan.
Circle described with a radius of 150 miles from the same point as above stated-namely power supplying district.
Red maked river indicates the site of generating stations of Daido Electric Power Co. and its associated cos.
Step-up. Sub-station.
Step-down Sub-station.
154,000 volts Transmission line under construction.
" " " " " preparation.
" " " " " contemplation.
77,000 volts Transmission line, constructed.
One Step-up sub-station, holding powers generated along the Kuzuryu River, Tetori River, & others.
Hatogaya " " " " " " Sho River & others
Funatsu " " " " " " Takahara River & others
Sakashita " " " " " " Kiso River & others
Iida " " " " " " Tenryu River & others
Osaka step-down sub-station supplying to Kyoto, Osaka, Kobe & localities.
Nagoya " " " " Nagoya & localities.
Hamamatsu " " " " Hamamatsu & localities.
Kofu " " " " Kofu & localities.
Kozu " " " " Kozu & "
Tokyo " " " " Tokyo, Yokohama & localities.
NAOEZU
CHIKUMA RIVER
NAGANO
SAI RIVER
Mt. ASAMA 8388 ft.
MAEHASHI
TAKAZAKI
TONE RIVER
KINU RIVER
ARA RIVER
EDO RIVER
FURAWA
Tate 20 ft.
Washiwa. 9375 ft
Norikura. 9985 ft
MATSUMOTO
AZUSA RIVER
LAKE SUWA
Mt. Tateshina. 8349 ft.
77 MILES
MIBU RIVER
Mt. Koma 9754 ft.
IIDA-STEP UP SUB-STATION
KOFU
KOFU STEP-DOWN SUB-STATION.
HACHIOJI
TAMA RIVER
TOKYO
SHINAGAWA. TOKYO STEP-DOWN SUB-STATION.
YOKOHAMA
48 MILES
42 MILES
BANU RIVER
Mt. FUJI 12467 ft.
ŌMIYA
HŌZU STEP DOWN. SUB-STATION.
60 MILES
102 MILES
FUJI RIVER
NUMAZU
Radius 150 Miles
SHIZUOKA
ABE RIVER
HAMAMATSU STEP-DOWN SUB-STATION
HAMAMATSU
PACIFIC OCEAN

Nezame, the site of an ancient legend, in the Midst of the dashing current of the Kiso River

II

OUTLINE OF THE ORGANIZATION

THE following outline describes in general the history and property of the organization together with the relation between the Daido and the Toho Electric Power Co.

HISTORY

The present Daido Electric Power Co. is the result of a combination of The Kiso Electrical and Industrial Co. established in 1918 with a capital of ¥18,600,000, The Osaka Transmission Co. established in 1919 with a capital of ¥20,000,000, and The Nippon Hydraulic Co. established in 1919 with a capital of ¥ 50,000,000. Mr. Fukuzawa, who is now President of the Daido, was then President of the first two companies, and Mr. Yamamoto, now a Director of the Daido, was then President of the last named company. The business purpose of these companies was the same, i.e. to transmit power to Osaka, Kyoto and their surrounding districts —one from the Kiso River and the other from the northern part of the country.

Intake, Ōkuwa Plant

These prominent men in the electrical and industrial field and several other prominent men of business held a conference with the purpose of initiating an era of desirable readjustment by calling into existence a super power zone in the most intensive manufacturing district of Japan, and it was decided in November, 1920, with unanimous approval to establish a limited corporation under the name of The Daido Electric Power Co., Ltd.

The head office of the company is at Tokyo with branch offices at Nagoya and Osaka. The personell of the Board of Management and the Executive is as follows:

President	MOMOSUKE FUKUZAWA
Vice President	KEISUKE MIYAZAKI
Managing Director	JIRO MASUDA, KOKI OTA, SHOSUKE MINE, SHIGERU KONDO, HISASHI SEKIGUCHI
Standing Auditor	CHOSHICHI ASANO
Director & General Manager	SUEICHI MURASE
Assistant Manager	SEIJI MOROI
Manager of Osaka Branch	MORIZO KIMURA

Dam (Weir) at Flood Time, Ōkuwa Plant

Among the directors and auditors are such prominent men as Kunisuke Okazaki, M. P., Jotaro Yamamoto, M. P., Tokuzo Shima, President of Osaka Stock Exchange, Zensuke Ohsawa, President of Kyoto Electric Light Co.

PROPERTY

The company is capitalized as follows:

Authorized Capital, Par Value ¥ 50				¥ 100,000,000
Capital Paid-up:				
Preferred Stock	372,000	shares @ ¥	30	11,160,000
Class " A " Common Stock.	120,000	,, ,,	25	3,000,000
Class " B " Common Stock.	1,508,000	,, ,,	20	30,160,000
Total				¥ 44,320,000

There is outstanding ¥ 29,140,064 of 7% debentures. After paying interest on the debentures in May, 1922 there was paid 6.4% dividend on the common and preferred stocks and 6% additional dividend on the preferred stock.

RELATION BETWEEN THE DAIDO AND THE TOHO ELECTRIC POWER CO

The relations between the Daido and Toho Electric Power Co. of which Mr. Fukuzawa was for the past thirteen years President (during which time he carried it from practically nothing to its present prosperity) are a matter worthy of special mention. Both companies have been in close relationship since their establishment.

At the time of the formation of the Daido in 1920 a mutual arrangement was made whereby the Daido undertook the duty of power development and transmission, and the Toho was to act as a distributing company in direct control of the demands of consumers.

In the written agreement between the Daido and Toho the following clause occurs.

"It is declared and also agreed that the Toho Electric Power Co. shall have the preferential right to a supply of electric power from the Daido Electric Power Co. from the power sites on the Kiso and Yahagi rivers which have already been granted by the Government and also those under application subject to the understanding that the Toho shall neither construct power plants with the intention of competing with the Daido nor purchase electric power from other than the Daido Electric Power Co."

The relation between these two companies goes back to the time of the foundation of the Kiso Electric Power & Steel Co. which developed in 1918 with a capital of ¥ 17,000,000, from the Nagoya Electric Light Co., the predecessor of the present Toho Electric Power Co. The Kiso Electric Power & Steel Co. was later renamed the Kiso Electrical and Industrial Co. and in 1920, the Daido was formed by combining this organization with two other companies.

The distribution of the stock of the Daido held by the Toho and its stockholders is as follows:

Shares held by the Toho.	529,150
Shares held by its stockholders	632,440
Total	1,161,590

Thus more than one-half of 2,000,000 total shares are at present held by the Toho Electric Power Co. and its stockholders.

III

ASSOCIATED COMPANIES UNDER THE DIRECTION OF MR. M. FUKUZAWA, PRESIDENT OF THE DAIDO

THE distinctive feature of the Daido Electric Power Co. is the union of capital combining all associated companies which possess available sites for hydro-electric power development in well-located position with reference to the power market of the country. In addition to the financial combination the company forms a ring of business corporations connecting with manufacturing and industrial companies such as electro-chemical works, electric railways, steel works and other activities. A brief summary of the properties forming the combination, which are under the managing control of Mr. Fukuzawa, together with their capitalization will be of interest.

Mr. M. Fukuzawa, President of the Daido Electric Power Company, Ltd

ASSOCIATED POWER PRODUCING COMPANIES

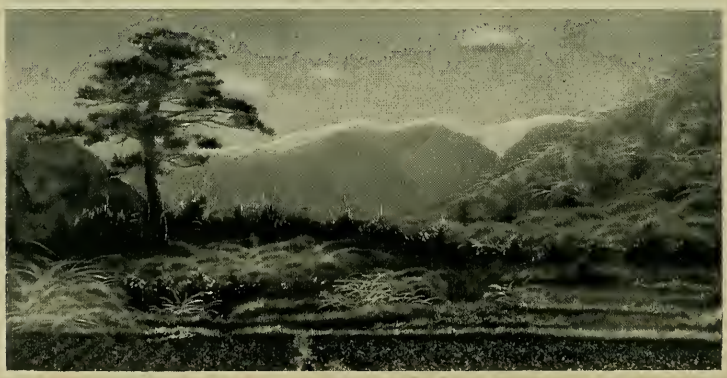
Name of Co.	Location	Authorized Capital	Capital Paid-up
Toho Electric Power Co.	Tokyo	¥ 139,821,200	¥ 99,994,235
Hakusan Water Power Co.	,,	10,000,000	2,500,000
Nōbi Electric Co.	Nagoya	3,000,000	750,000
Bisan Electric Power Co	,,	5,000,000	1,250,000
Yahagi Water Power Co.	,,	5,750,000	3,450,000
Fukui Electric Power Co	Fukui	500,000	125,000
Tateyama Water Power Co.	Toyama	2,000,000	1,500,000
Hokuriku Transmission Co.	,,	2,000,000	500,000
Tenryugawa Electric Power Co.	Hamamatsu	50,000,000	500,000
Gifu Electric Power Co.	Tokyo	5,000,000	1,250,000
Nanshin Electric Co.	Nagano	1,000,000	500,000
Kameoka Water Power Co.	,,	5,000,000	1,250,000
Oshirakawa Water Power Co.	,,	2,000,000	500,000
Nagaragawa Water Power Co.	Gifu	1,000,000	250,000
		¥ 232,071,200	¥ 114,319,235

ASSOCIATED POWER USING COMPANIES

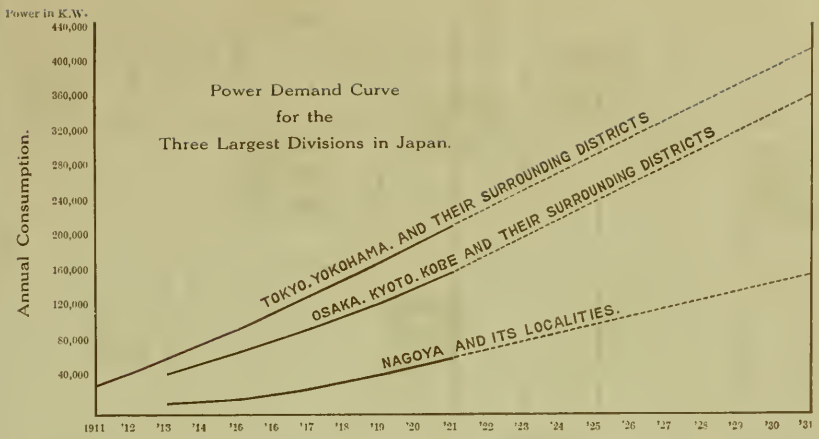
Name of Co.	Location	Authorized Capital	Capital Paid-up
Daido Fertilizing Co.	Fukui	¥ 3,000,000	¥ 2,520,000
Daido Steel Works	Nagoya	1,000,000	1,000,000
Electric Steel Works	Tokyo	2,788,000	1,644,000
Hōkoku Cement Co.	Nagoya	7,500,000	4,700,000
Nagoya Refrigerating Co.	,,	150,000	150,000
Kitayena Railway Co.	,,	2,000,000	200,000
Tokai Soda Mfg. Co.	,,	1,250,000	662,500
Aichi Electric Railway Co.	,,	15,162,500	4,675,000
Tokai Electrode Mfg. Co.	Tokyo	1,000,000	525,000
Yahagi Cableway Co.	Gifu	250,000	125,000
Yahagi Reclaiming Co.	,,	500,000	250,000
Nagoya Warehouse Co.	Nagoya	3,600,000	900,000
Togen Industrial Co.	,,	320,000	320,000
		¥ 38,520,500	¥ 17,671,500

Briefly the total capital of this great combination exceeds ¥ 370,000,000 and the amount paid up is over ¥ 176,000,000.

Part of Viaduct used for carrying materials to Momoyama Power Plant



Mt. Koma, 10,000 ft. high, is covered with perpetual snow. Mt. Koma and Mt. Ontake face each other across the Upper Kiso River and constitute its chief Source of Power Ref. Map II



IV

SUPPLY AND DEMAND OF POWER IN CENTRAL JAPAN

GROWING DEMAND FOR POWER

ON the mainland of Japan there are 31 Prefectures, including 15 large cities and about 200 towns. From the point of view of supply and demand of power, it may be divided into the following three divisions.

Division I Tokyo, Yokohama and their surrounding districts
,, II Nagoya and locality
,, III Osaka, Kobe, Kyoto and their surrounding districts

It is estimated that these 3 divisions will require approximately 70% of the total power demand on the mainland. A statement as to the supply of power to these districts up to June, 1922 is:

	Steam Power	Water Power	Total Present Supply
Division I	15,000 K.W.	200,000 K.W.	215,000 K.W.
,, II	10,000 ,,	60,000 ,,	70,000 ,,
,, III	130,000 ,,	50,000 ,,	180,000 ,,
	155,000 K.W.	310,000 K.W.	465,000 K.W.

According to the statistical report of the Government since 1911 the annual rate of power demand in these 3 divisions is as follows:

Division I	20,000 K.W.
,, II	10,000 ,,
,, III	20,000 ,,
Total	50,000 K.W.

With the above ratio of annual increase of power demand, total requirements for each division at the end of 5 years and 10 years would be as follows:

	Present Supply	Total Requirements after 5 Years	Total Requirements after 10 Years
Division I	215,000 K.W.	315,000 K.W.	415,000 K.W.
,, II	70,000 ,,	120,000 ,,	170,000 ,,
,, III	180,000 ,,	280,000 ,,	380,000 ,,
Total Requirement	465,000 K.W.	715,000 K.W.	965,000 K.W.
Total Increase	—	250,000 ,,	500,000 ,,

POWER REQUIREMENTS FOR RAILWAY ELECTRIFICATION

A very important matter to be considered is the power which will be required for railway electrification. The work of electrifying the Imperial Government Lines is expected to be under way in the very near future. It is a question whether the supply of power will be furnished by existing public service corporations or by new generating system to be built by the Government, but from the standpoint of sound engineering and economics there can be no doubt as to the better policy to invest the enormous sums of money required for separate power plants for the sole purpose of generating power for railway use would be folly when there are plants already existing capable of supplying all the power required at much lower cost per K.W.H. We believe therefore that the final conclusion of a careful study of this matter will result in the purchase of power from existing operating companies.

The estimated power requirements for electrification of the various railroad sections in Central Japan are as follows:

	Miles	K.W. per Mile	Power Required
Tokaido Lines	374	200	74,800
Chuwo ,,	301	150	45,150
Hokuriku ,,	228	150	34,200
Kansai ,,	119	150	13,350
Sangu ,,	45	150	6,750
Tokyo & Vicinity.	197	150	29,550
Osaka, Kyoto & Vicinity.	150	150	22,500
Total.	1,414		226,300

Intake during Construction (now completed),
Suhara Power Plant

It is expected that electrification of the railroads will be completed in approximately 10 years, and in estimating the probable demand, consideration should be given to the probable increase of transportation on all lines. These figures show the great importance to the country of the development of hydro-electric power particularly in the central portion, the industrial heart of the country, and should receive the greatest consideration from the public at large.

ESTIMATED WATER POWER IN CENTRAL JAPAN

According to the investigation of the Hydraulic Bureau of the Government, the total estimated value of the water power in the whole of Japan is approximately 10,000,000 K. W. of which 7,000,000 K. W. is to be found on the mainland of the country and may be classified as follows:

Economically applicable	5,500,000 K. W.
Economically inapplicable. . . .	1,500,000 ,,

The rivers running through the central portion of Japan, which are commercially practicable for the development of long distance transmission and have a combined capacity of 4,550,000 K.W. are listed with their estimated capacities as follows:

Abukuma River	. . . . .	200,000 K.W.
Tone	,, ...	500,000 ,,
Sagami	,, ...	150,000 ,,
Sakai	,, ...	70,000 ,,
Fuji	,, ...	150,000 ,,
Ohi	,, ...	150,000 ,,
Akano	,, ...	500,000 ,,
Shinano	,, ...	750,000 ,,
Arakawa	,, ...	60,000 ,,
Hime	,, ...	100,000 ,,
Tenryu	,, ...	300,000 ,,
Yahagi	,, ...	70,000 ,,
Kiso	,, ...	500,000 ,,
Kurobe	,, ...	200,000 ,,
Jintsu	,, ...	250,000 ,,
Shokawa	,, ...	150,000 ,,
Tetori	,, ...	100,000 ,,
Kuzuryu	,, ...	100,000 ,,
Kumano	,, ...	120,000 ,,
Yodo	,, ...	130,000 ,,
Hida	,, ...	70,000 ,,
Others	. . . . .	30,000 ,,
		4,650,000 K.W.

Of the above rivers, the last named eleven are considered to have the most economical sites for power development. Their aggregate capacity is 2,900,000 K.W. Of these eleven rivers all except the Kurobe, Kumano and Yodo are either under operation or in some stage of development. The aggregate capacity which is under the control of the Daido and its associated companies as shown by the following table is over 1,000,000 K.W.

Intake and Dam (Diversion Weir) Ōkuwa Power Plant

Name of Companies	Power in Operation	Power under Construction	Power under Plan of Work	Total	Power under Application	Grand Total
	K.W.	K.W.	K.W.	K.W.	K.W.	K.W.
Daido. . . .	48,100	119,200	82,080	249,380	264,042	513,422
Toho	37,769	3,772	44,745	86,286	162,235	248,521
Yahagi . . .	8,050	5,000	8,000	21,050	40,000	61,050
Bisai. . . .	1,431	6,513	6,912	14,856	2,348	17,204
Nohi	144	3,950	1,170	5,264	55,166	60,430
Hakusan . .	—	32,000	14,982	46,982	45,565	92,547
Gifu	—	6,000	57,560	63,560	—	63,560
Tenryugawa .	—	—	—	—	143,303	143,303
Total. . .	95,494	176,435	215,449	487 378	712,659	1,200,037

V

PRESENT AND FUTURE DEVELOPMENT

POWER PLANTS AND CAPACITIES

A summary of the power plants now operated by the Daido together with those under construction and in other stage of development is given below.

1 Power Plants in Operation

Shizumo	14,700 K.W.
Ōkuwa	11,000 ,,
Kushihara	6,000 ,,
Nishikadohara	7,200 ,,
Suhara	9,200 ,,
	48,100 K.W.

2 Power Plants under Construction

Kema (Steam)	12,500 K.W.
Yomikaki	40,700 ,,
Ohi	42,900 ,,
Momoyama	23,100 ,,
	119,200 K.W.

3 Power Plants Contemplated

Nezame	7,300 K.W.
Ochiai	13,700 ,,
Kasagi	17,000 ,,
Nishikitsu	18,000 ,,
Imawatari No. 1	8,490 ,,
Imawatari No. 2	3,990 ,,
Hanafusa	10,000 ,,
Higashikadohara	1,300 ,,
Shimouchinami	2,300 ,,
	82,080 K.W.

TRANSMISSION LINES

The proposed plan is to have a gigantic network of transmission lines covering the middle western part of Japan.

1 Completed and in Operation

163 miles of 77,000 volt line of which 100 miles has steel tower construction, and 63 miles wooden poles from power plants along the Kiso and Yahagi rivers to Nagoya.

90 miles of 154,000 volt line, steel tower construction, from Kiyosu to Osaka.

30 miles of 66,000 volt line from power plants along the Kuzuryu river to Takefu.

2 Under Construction

76 miles of 77,000 volt line, steel tower construction, from power plants along the Kuzuryu river to Nagoya, to be completed by April, 1923.

65 miles of 154,000 volt line, steel tower construction, from Suhara power plant on the Kiso river to Kiyosu, to be completed by August, 1923.

3 Under Preparation

212 miles of 154,000 volt line, steel tower construction, from Hokuriku to Osaka, to be known as Hokuriku Transmission Trunk Line.

70 miles of 77,000 volt line, steel tower construction, from the Jintsu river power site to Nagoya.

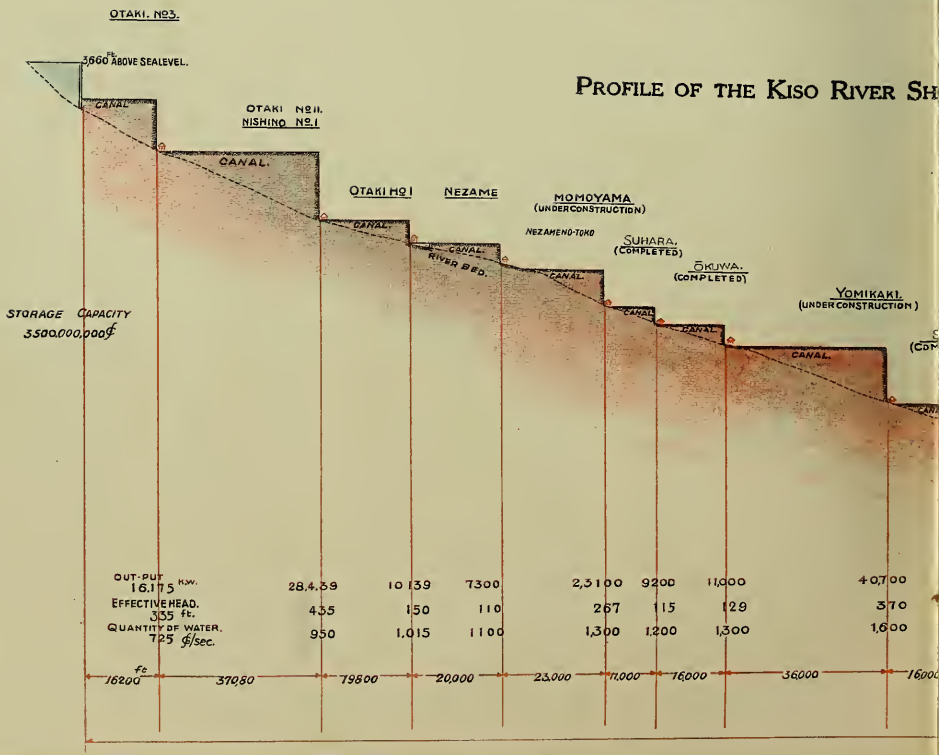
51 miles of 55,000 volt line, steel tower construction, from Osaka to Wakayama.

35 miles of 77,000 volt line, steel tower construction, connecting power plants between the Seki and Kiso river.

There are also plans covering the transmission of power to Tokyo, and in general, the main transmission system will, when completed, extend for approximately 1,110 miles, and be so advantageously located along the Government Railways that it will be available for their electrification. (Ref. Map H)

PC

PROFILE OF THE KISO RIVER SH



MAP III

ER STATIONS ON THE KISO RIVER

Scale: 1 : 1,000,000

(1922)
July

River
Position of water Gauge
Ridge Line
H.E.P. Plant Completed
Under Construction
Proposed

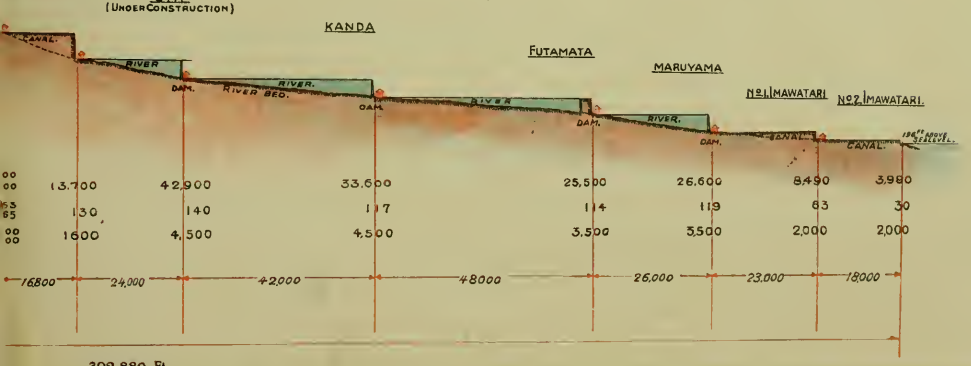
VING THE LOCATIONS OF WATER POWER PLANTS

Total Height from No. 2 Imawatari Power Station to Otaki No. 3 Power Station...		3464 Ft.
Quantity of Water (Variable at each Power Station)		725-4500 Cub. Ft/sec.
Total Out-Put		315,533 K.W.
Distance from No. 2 Imawatari Power Station to No. 3 Otaki Power Station ...		392,880 Ft.

IMO.
TEO)

OCHIAI.

Scale: 1/6000/20,000.



392,880 Ft.

HYDRO-ELECTRIC POWER DEVELOPMENT ON THE KISO RIVER

The power plants of the Daido situated along the whole course of the Kiso river are as follows. (Ref. Map III)

Plants	Volume	Head	Capacity	Water Way	System
	cu. ft.	ft.	K.W.	mile	
Nezame	1,100	110.0	7,300	2.8	Canal
Momoyama	1,300	267.0	23,100	2.7	,,
Suhara	1,200	115 0	9,200	2.0	,,
Okuwa	1,300	129.0	11,000	2.6	,,
Yomikaki	1,600	370.0	40,700	6.7	,,
Shizumo	1,300	153.0	12,600	3.0	,,
Shizumo Extension	200	165.0	2,100	—	,,
Ochiai	1,600	130.0	13,700	4.7	,,
Ohi	4,500	140.0	42,900	—	Dam
Kanda	4,500	117.0	33,600	—	,,
Futamata	3,500	114.0	25,500	—	,,
Maruyama	3,500	119.0	26,600	—	,,
Imawatari No. 1.	2,000	63.0	8,490	2.0	Canal
,, No. 2.	2,000	30.0	3,990	1.9	,,
Total Capacity			K.W. 260,780		

Of the total power to be developed on the Kiso river, 34,900 K.W. is now in operation, 110,700 K.W. under construction, and 118,540 K.W. under contemplation. Besides 6,000 K.W. on the Yahagi and 7,200 K.W. on the Kuzuryu are now in operation. According to the power hydrograph of the Kiso river, approximately 545,000,000 K.W.H. of steady power and 440,000,000 K.W.H. of unsteady power will be produced annually at the sites located on the stream above the Shizumo Power House. It is estimated that the total construction cost for these power plants on the Kiso river from Nezame to Ohi will amount to approximately ¥ 48,700,000 and the average cost per kilowatt ¥ 315.

OHI POWER PLANT-DAM SYSTEM

The Ohi Plant is intended to undertake the supply of power for peak load of Osaka Sub-station, thus keeping the load of other plants such as Momoyama, Suhara, Okuwa and Yomikaki nearly constant. This base load will amount to approximately 100,000 K.W.

The load factor for Ohi plant will be certainly below 50% but the average load factor for all plants running together in parallel is estimated to be about 75%, as the other plants with the exception of Ohi will have naturally very good figures due to the nature of their loads.

The present work of the Daido is in the primary stage. The secondary period of power development on the Kiso and its tributaries will begin in the near future, and upon its completion most of the power produced will be taken for base load at the Ohi plant.

OTAKI RESERVOIR

The rivers having their sources in the plateau of the "Japan Alps" are usually low in run-off during the two winter months of January and February. The principal purpose of Otaki Reservoir is to supply water during this dry season, and to regulate the discharge at other times.

The reservoir is to be constructed by a dam wall 300 feet high and the capacity will be 3,200,000,000 cubic feet. The regulated flow from this reservoir will produce an additional 320,000,000 K. W. H. during the dry season, and upon completion of the whole power development on the Kiso river, the total capacity of 823,000,000 K.W.H. It is expected that the reservoir will be completed by the end of 1924.

PROPOSED SCHEME OF POWER DEVELOPMENT

ON THE TENRYU RIVER

There are ten sites along the Tenryu river suitable for power development and their total capacity is approximately 250,000 K. W. Data on these sites are as follows: (Ref. Map IV)

Sites	Volume	Head	Capacity	Water Way	System
	cu. ft.	ft.	K.W.	mile	
No. I . . .	1,200	37.5	2,832	0.5	Canal System
No. II . . .	1,300	46.0	3,763	2.2	,,
No. III . .	1,360	251.0	21,324	6.4	,,
No. IV. . .	1,700	215.0	23,000	7.5	,,
No. V . . .	1,900	51 0	6,058	2.4	,,
No. VI. . .	3,500	140.0	30,837	1.1	Dam System
No. VII . .	3,700	72.0	16,765	—	,,
No. VIII . .	4,000	100.0	25,551	—	,,
Otani . . .	4,310	140.0	41,150	—	,,
Sakuma . .	4,780	250.0	81,500	—	,,
Total Capacity . . .			K.W. 252,780		

At the upper end of the Tenryu river, Lake Suwa, having a catchment area of over 208 square miles, forms a natural storage reservoir. For about 40 miles from Tokimata to Futamata the river flows through the great Tenryu canyon, a place of grand scenic beauty, bordered on either side by ranges of steeply rising hills and providing sites most suitable for dam construction.

The company is now rapidly carrying out the work of surveying, locating etc. This river is in striking contrast to many others in that the volume of water is so constant that the minimum run-off for eleven months can be taken as the basis

Part of Kushihara Transmission Line

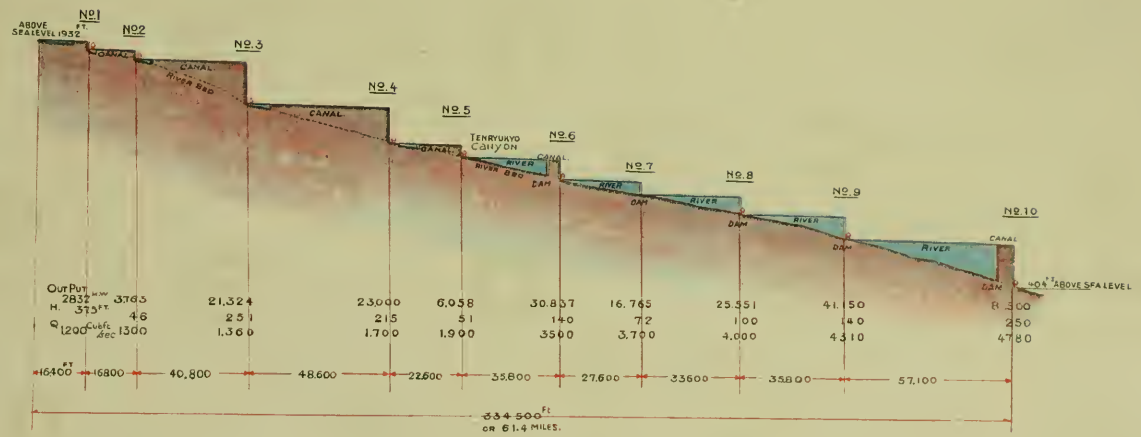
for power development, and no provision for steam power plants for emergency use is necessary. If however a steam reserve is provided and the design changed to the eight months minimum run-off, a total capacity of 400,000 K. W. can be obtained with a total construction cost of ¥ 300 per kilowatt.

It is estimated that total construction cost for these ten power plants will amount to approximately ¥ 87,000,000 or ¥ 344 per kilowatt. The Tenryu river is undoubtedly one of the finest rivers for power development in Japan.

MAP IV

POWER STATIONS ON THE TENRYU RIVER

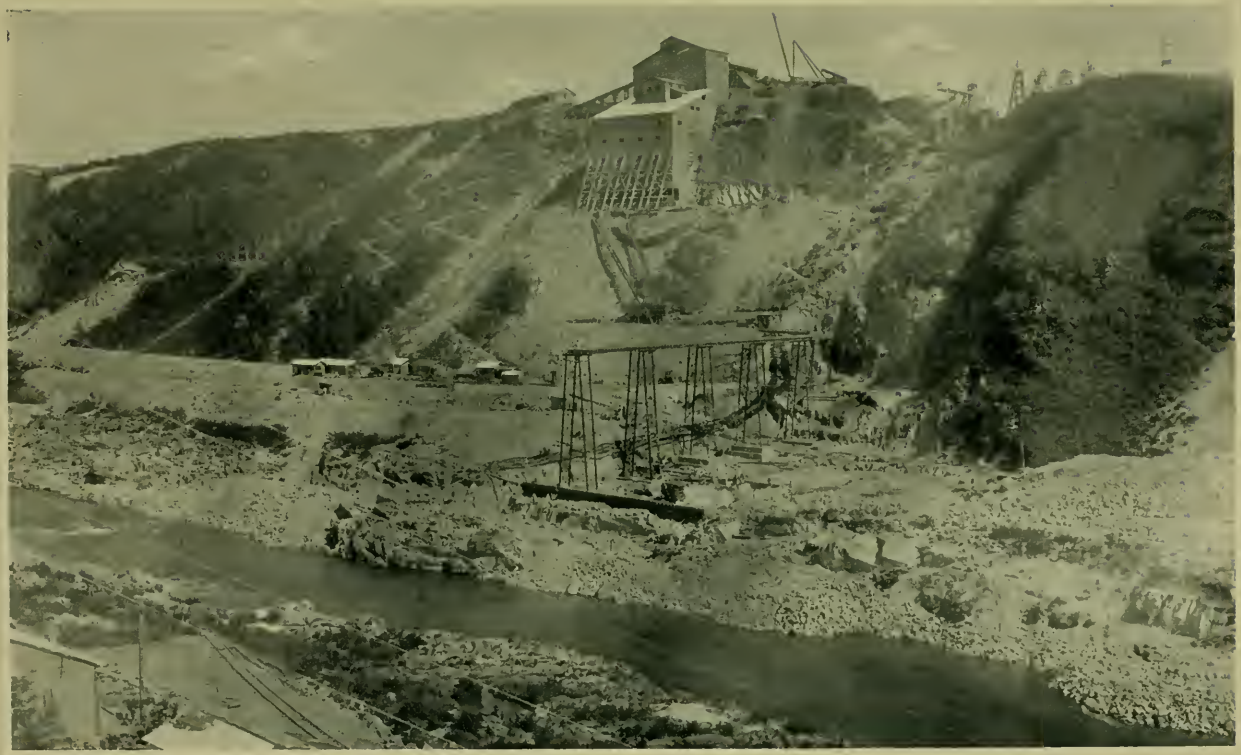
Profile of the Tenryu River Showing the Locations of Water Power Plants



Total Height from No. 1 to No. 10 Power Station ... ... 1,528 Ft.
Quantity of water (Available at each Power Station) ... ... 1,200-4,780 Cub.ft./sec.
Total Out-put ... ... 252,780 K.W.
Distance from No. 1 to No. 10 Power Station... ... ... 334,500 Ft. or 61,4 Miles.

Scale: 1/6,000/300,000

Transmission Tower near Kameyama, midway between Nagoya and Osaka on 154,000 V. 96 mile Osaka Transmission Trunk Line; Elevation of Mountain Range at this Point 1,000 ft.



Ohi Dam under Construction. The whole Plant to be completed by Jan. 1924. Output 42,900 K. W.

Log Slide and Over-flow, Kushihara Plant

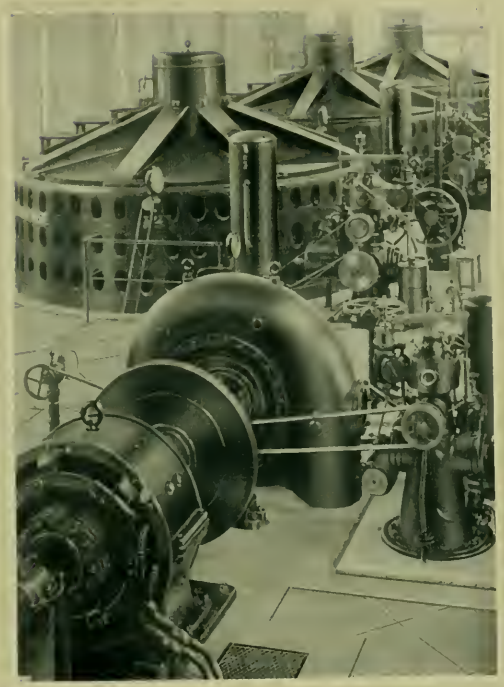
VI

PRINCIPAL SOURCE OF POWER DEMAND

PRINCIPAL POWER MARKET

ONE of the most important considerations involved in the sale of power is location. It is a matter to which every investor should give careful consideration.

Fortunately the source of hydro-electric power in the central portion of Japan



Interior View of Ōkuwa Power House

is easily within reach of Tokyo, Yokohama, Nagoya, Kyoto, Kobe and Osaka, the principal power markets of the country. The following illustrations show the importance of our position as a supplying company with reference to the most intensive manufacturing centers of the country. The principal consumers are as follows:

1. The Toho Electric Power Co. with Nagoya as the principal center and extending to Toyohashi, Gifu, Hamamatsu, Okazaki, Yokkaichi, and Nara in the central district.

2. The Osaka Electric Light Co. dealing in light and power, and other urban

Intake Site of Proposed No. 4 on the Tenryu River

and interurban traction companies, and industrial companies located in and near the city of Osaka.

3. The Kyoto Electric Light Co. which is supplying light and power in the city of Kyoto and the neighbouring district, and also in the Prefecture of Fukui.

4. The Keihan Electric Traction Co. which carries on a traction business and also supplies light and power, and other industrial companies located in Kyoto, Osaka and their surrounding districts.

5. The municipal government of Kobe, Kawasaki Dockyard, and other industrial companies located in Kobe and its environs.

6. The municipal government of Tokyo and the Tokyo Electric Light Co. are the principal factors with which the Daido should cooperate in supplying power to Tokyo, Yokohama and their surrounding districts upon completion of the proposed Tokyo transmission system.

Part of the Tenryu Canyon

Thus the greater part of the power generated is delivered over the transmission lines to the sub-stations of the wholesale consumers who in turn distribute it to the smaller consumers.

Tunnel Work under Direction of American Engineers at Yomikaki Plant.

100 H. P. Motor for Compressor being carried over the Kiso River

In brief, light and power to be consumed by these cities and companies are as follows:

	Lights Installed	Power Sold
Osaka Electric Light Co . . .	1,538,927	87,222 H.P.
Osaka City	—	5,830 ,,
Kyoto Electric Light Co. . . .	593,903	28,406 ,,
Kyoto City	235,403	10,012 ,,
Keihan Electric Traction Co. . .	96,903	11,668 ,,
Kobe City	423,182	20,372 ,,
Tokyo City	707,438	31,291 ,,
Tokyo Electric Light Co. . . .	3,367,823	235,394 ,,
Toho Electric Power Co. . . .	1,904,438	114,597 ,,
Total	8,868,017	544,792 H.P.
Whole Country	14,167,685	1,359,208 H.P.
Per Cent. of Whole Country . .	62%	40%

VII

THE FRIENDLY RELATIONS EXISTING BETWEEN AMERICAN MANUFACTURERS AND THE DAIDO

MOST of the equipment installed in the generating stations, sub-stations, and transmission lines, including water turbines, generators, switch-boards, transmission towers, insulators, and other machinery, are of American manufacture. This is due to the business position gained in the world's markets by America as a result of the world war. The war afforded America tremendous opportunities, as she became practically the only supplier nation of the whole world. It also gave her citizens an opportunity for improvement in their trade methods, and manufacturers and businese men who had grown up during the past century with the home markets uppermost in their minds, now look to foreign rather than domestic business for their great opportunity.

To date, the foreign machinery and equipment used in the construction work of the Daido, amounts to over ¥ 14,000,000 of which about 90% is of American manufacture. We believe, in consequence, it is no exaggeration to say that the existing friendly relations between American business men and the Daido Electric Power Co. as well as its associated companies, will increase more and more with the progress of hydro-electric development in Japan, and will help to make the Pacific the greatest highway of commercial intercourse connecting the East and the West.

Osaka Sub-station under Construction to be completed by Sept. 1923. Of a total output 120,000 K. W., 20,000 K. W. is already in Operation

Head Tank, Shizumo Plant

GENERAL BALANCE SHEET, MAY 31, 1922

ASSETS

Uncalled Capital	¥ 55,680,000.000
Power House Construction	16,478,649.942
Transmission Line.	2,366,803.092
Sub-Station Construction.	1,455,081.386
General Construction A/C	7,054,562.326
Telephone Line	16,609.270
Distribution Line	35,732.074
Real Estate	5,519,332.320
Furniture & C.	169,457.690
Future Extension & Development A/C	29,522,492.575
Store's A/C	415,235.509
Commission on Sale of Debentures	392,855.000
Pending A/C Receivable.	6,612,996.879
Bills Receivable	337,058.460
A/C Receivable	405,037.880
Stock of Other Companies Invested	7,832,823.900
Securities Deposited	2,029,452.500
Deposit in Bank	410,218.140
Cash on Hand	46,545.510
Total Assets	¥ 136,780,944.453

LIABILITIES

Authorized Capital	¥ 100,000,000.000
Legal Reserve.	303,608.000
Debentures	10,000,000.000
Debts & Bills Payable	19,140,064.980
Employee's Savings.	84,686.330
Pending A/C Payable	3,790,643.210
A/C Payable	1,795,183.490
Unpaid Dividends	38,917.710
Balance Brought Down	59,210.143
Surplus	1,568,630.590
Total Liabilities.	¥ 136,780,944.453

CONDENSED FINANCIAL STATEMENT

For the Six Months Ending May 31, 1922

INCOME:

Business Income	¥ 1,873,460,850
Interest & Profit on Securities	304,071,167
Miscellaneons Income	32,073,235
Total	¥ 2,209,605,252

EXPENSE:

Operating Expense	¥ 194,259,829
Taxes	94,438,960
General Expense	352,275,873
Total	¥ 640,974,662

Net Profit for the Six Months ¥ 1,568,630,590

DIVIDEND RECORD

Dividends are payable June and December, and the rates since 1921 are listed as follows:

	1921	1922
First Half	6%	6.4%
Second Half	6.2%	

CONSTRUCTION COST

GENERATING STATIONS

Name of Plant	Capacity	In Operation	Under Construction	Cost per K.W.
	K.W.	¥	¥	¥
Shizumo	14,700	5,086,077.219		345.992
Ōkuwa	11,000	5,112,782.483		464.798
Kushihara	6,000	3,474,663.577		579.111
Nishikadohara	7,200	2,670,636.110		370.922
Suhara	9,200	4,545,715.000		494.099
Yomikaki	40,700		13,748,069.220	337.790
Ohi	42,900		12,243,300.000	285.392
Momoyama	23,100		6,640,000.000	287.446
Kema (Steam)	12,500		3,036,500.700	242.920
Total	167,300	20,889,874.389	35,667,869.920	

Total Construction Cost ¥ 56,557,744.309

Average Cost per K. W. ¥ 338.062

SUB-STATIONS

Name of Sub-Station	Capacity	In Operation	Under Construction
	K.V.A.	¥	¥
Rokugo	15,000	393,064.938	
Mizuho	9,000	315,941.412	
Tokitsu	1,050	91,013.592	
Tōgō	450	38,898.210	
Takefu	8,100	183,131.400	
Osaka	441,000	8,868,800.000	
Rokugo No. 2	15,000		433,031.830
Sango	15,000		500,000.000
Suhara	50,400		1,554,000.000
Mizuho No. 2	9,000		276,000.000
Total		9,890,849.552	2,763,031.830

Total Construction Cost ¥ 12,653,881.382

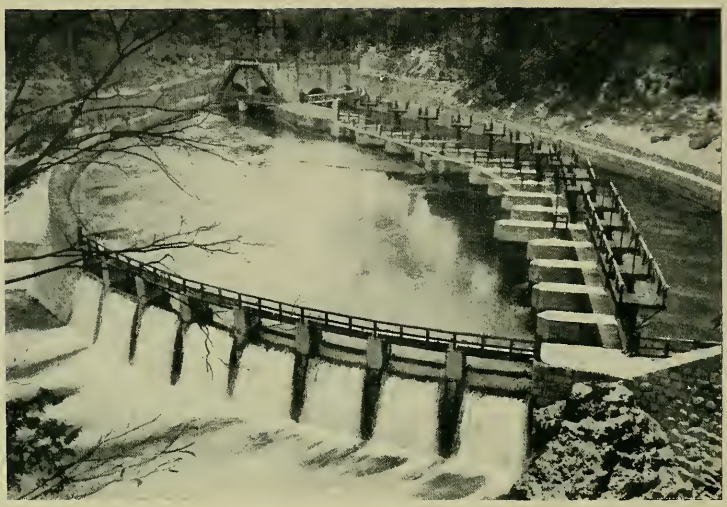
Average Cost per K. W. ¥ 75.636

TRANSMISSION LINES

Name of Line	Length	In Operation	Under Construction
	mile	¥	¥
Shizumo to Rokugo	48.2	1,059,571.328	
Kushihara to Mizuho	30.6	773,583.808	
Kushihara to Mizunami	16.3	183,615.336	
Nishikadohara to Takefu	29.7	350,032.620	
Nagoya to Osaka	88.0	8,078,750.000	
Nojiri to Nagoya	58.0	2,686,300.000	
Suhara to Nojiri	3.0	98,000.000	
Kachikawa to Kiyosu	6.4	326,185.000	
Momoyama to Suhara	3.0		122,175.000
Kiyosu to Suhara	6.7		5,360,150.000
Kema to Sango	3.5		549,000.000
Sango to Furukawabashi	1.5		53,150.000
Tokise to Yodaira	2.5		89,200.000
Kushihara to Mizuho	30.6		181,000.000
Seki to Kiyosu	22.0		1,562,872.000
Total		13,556,338.092	7,917,847.000

Total Construction Cost	¥ 21,474,185.092
Average Cost per K. W.	¥ 128.357

The total construction cost for generating stations, sub-stations, and transmission lines in operation amounts to ¥ 44,337,062.042, and for the work under construction ¥ 46,348,748.750. The average cost per kilowatt for the whole work amounts to ¥ 542 055.



Settling Basin, Shizumo Plant

FUTURE BUSINESS PROSPECTS

The prospects of the Daido Electric Power Co. with its natural resources and geographical advantages are exceptionally bright. Early in 1924 the total power developed will exceed 167,000 K. W. and the transmission system will extend more than 500 miles. A total number of 8 water plants and one steam plant will be in operation. The average construction cost for generating stations, sub-stations, and transmission lines inclusive does not exceed ¥ 550 per kilowatt. It is expected therefore that within two years the Daido will be in a position to declare dividends on its shares at the rate of at least 12 per cent. per annum.

"Taikaku Kyo" specially built for Shizumo Power House

SHIZUMO POWER STATION

Effective Discharge	Max.	1,475 Cub. ft./sec
	Min.	885 „
Effective Head		163 ft.
Theoretical Horse Power	Max.	25,519 H.P.
	Min.	15,284 „
Out-put in K.W.	Max.	14,700 K.W.
	Min.	8,400 „
Total Length of Water Way		15,969 ft.
Length of Tunnel		14,630 ft.
Work Began		Oct.—1918
Work Completed		Oct.—1919

Main Turbine:

3—7500 H. P. (Max.) 360 R.P.M.
Twin spiral, single discharge, horizontal shaft.
Maker—*Boving.*

1—3850 H.P. (Max.) 514 R.P.M.
Single spiral, single discharge, vertical shaft.
Maker:—*Okumura.*

Main Generator:

3—5,250 K.V.A., 80% P.F., 360 R.P.M. 6,600 V.
3 phase, 60 cycle.
Maker:—*General Electric.*

1—3,000 K.V.A., 80% P.F., 514 R.P.M. 6,600 V.
3 phase, 60 cycle.
Maker:—*Okumura.*

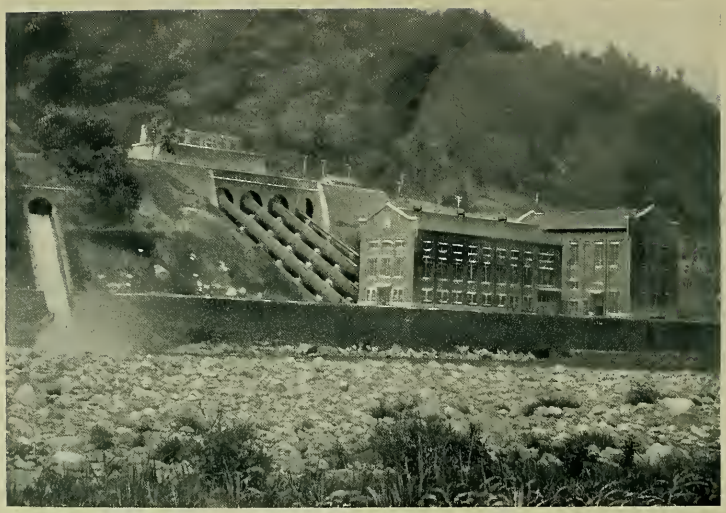
Transformer:

7—2630 K.V.A., 6,600/77,000 V. delta-delta-
Maker:—*Westinghouse.*

1—3,000 K.V.A., 3 phase, 6,600/77,000 V, delta-delta.
Maker:—*Okumura.*

Switchboard:

Type:—*Panel type.*
Maker:—*Shibaura.*



General View of Ōkuwa Power House

ŌKUWA POWER STATION

Effective Discharge.	Max.	1,300 Cub. ft./sec
	Min.	639 „
Effective Head.		127 ft.
Theoretical Horse Power.	Max.	18,600 H.P.
	Min.	9,300 „
Out-put in K.W.	Max.	11,000 K.W.
	Min.	5,600 „
Total Length of Water Way.		13,821 ft.
Length of Tunnel.		7,772 ft.
Work Began.		Oct.—1919
Work Completed.		July—1920

Main Turbine:
3—5,800 H.P. (Max.), 277 R.P.M.
Single spiral, single discharge vertical.
Maker:—*Allis-Chalmer.*

Main Generator:
3—5,000 K.V.A., 80% P.F., 6,600V, 3 phase 60 cycle.
Maker:—*Westinghouse.*

Transformer:
4—5,000 K.V.A. 6,600/77,000V., delta-delta, (1-spare)
Maker:—*Westinghouse.*

Switchboard:
Type:—*Bench type.*
Maker:—*Shibaura.*

General View of Kushihara Power House

KUSHIHARA POWER STATION

Effective Discharge.	Cub. ft./sec	
	MAX.	393
	MIN.	260 „
Effective Head.		231 ft.
Theoretical Horse Power.	MAX.	10,252 H.P.
	MIN.	6,853 „
Out-put in K.W.	MAX.	6,000 K.W.
	MIN.	3,000 „
Total length of Water Way.		20,734 ft.
Length of Tunnel.		10,791 ft.
Work Began		Oct.—1919
Work Completed.		Dec.—1920

Main Turbine :

2—5,500 H.P. (Max.)., 514 R.P.M.
Double spiral, double discharge horizontal shaft.
Maker :—*Hidachi.*

Main Generator :

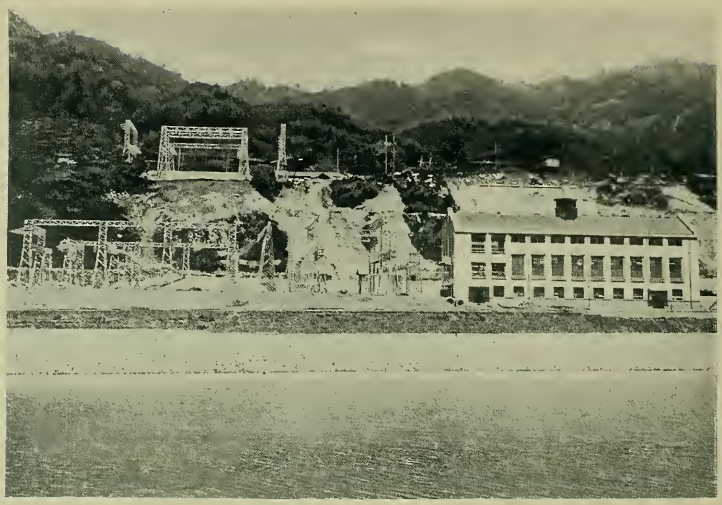
2—3,750 K.V.A., 80% P.F., 6,600 V, 3 phase, 60 cycle.
Maker :—*Hidachi.*

Transformer :

7—1,500 K.V.A., 2,300—6,600/77,000 V delta-delta (1-spare).
Maker :—*Shibaura.*

Switchboard :

Type—*Panel type.*
Maker :—*Shibaura.*



Suhara Power House in Operation and Sub-station under Construction

SUHARA POWER STATION

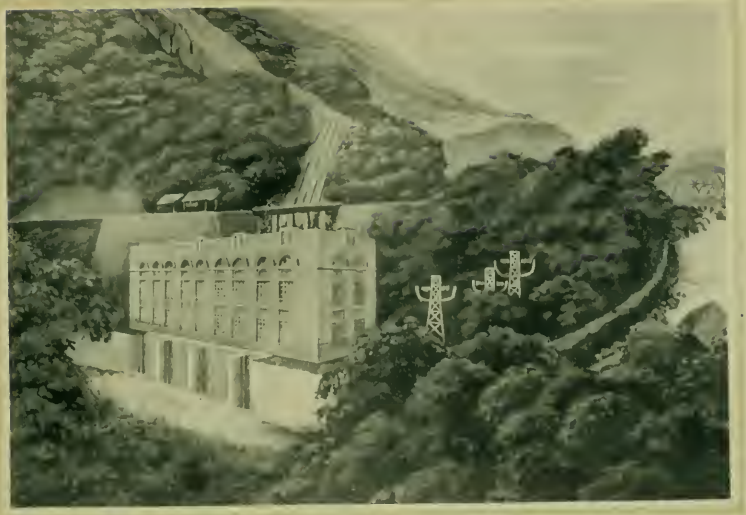
Effective Discharge		Cub. ft./sec
	Max.	1,300
	Min.	390 „
Effective Head		114.49 ft.
Theoretical Horse Power		15,343 H.P.
Out-put in K.W.		
	Max.	9,200 K.W.
	Min.	4,600 K.W.
Total length of Water Way		10,698 ft.
Length of Tunnel		3,978 ft.
Work Began		May—1920
Work Completed		July—1922

Main Turbine:
Single spiral, single discharge, vertical type.
2—7,500 H.P. (Max.), 225 R.P.M.
Maker:—*Escher Wyss.*

Main Generator:
2—5,500 K.V.A., 80% P.F., 6,600V, 3 phase, 60 cycle.
Maker:—*Westinghouse.*

Transformer:
4—4,500 K.V.A., 6,600/77,000V, delta-delta. (1-spare).
Maker:—*Hidachi.*

Switchboard:
Type—*Bench type.*
Maker:—*Shibaura.*



Yomikaki Power House as it will appear when completed

YOMIKAKI POWER STATION

Effective Discharge	Max.	1,573 Cub. ft./sec
	Min.	963 „
Effective Head		367 ft.
Theoretical Horse Power	Max.	65,712 H.P.
	Min.	40,249 „
Out-put in K.W.	Max.	40,700 K.W.
	Min.	24,954 „
Total Length of Water Way		36,346 ft.
Length of Tunnel		31,880 ft.
Work Began		Dec.—1921
To be Completed		Sept.—1923

Main Turbine:

Single spiral, single discharge, vertical type.
3—22,000 H.P. (Max.), 360 R.P.M.
Maker:—*Escher Wyss.*

Main Generator:

3—17,000 K.V.A., 80% P.F., 6,600V., 3 phase 60 cycle.
Maker:—*Westinghouse.*

Transformer:

9—8,500 K.V.A. 6,600/89,000V, delta-star neutral ground thro' resistance. (3 spare).
Maker:—*General Electric*

Ohi Dam as it will appear when completed

OHI POWER STATION

Effective Discharge.	Cub. ft./sec MAX. 4,424 MIN. 575 „
Effective Head.	140 ft.
Theoretical Horse Power.	MAX. 69,300 H.P. MIN. 9,125 „
Out-put in K.W.	MAX. 42,900 K.W. MIN. 5,150 „
Max. Height of Dam.	182 ft.
Length of Pressure Tunnel.	2,982 ft.
Work Began.	Jan.—1922
To be Completed.	Dec.—1923

Main Turbine:
Single spiral, single discharge vertical type.
4—18,000 H.P. (Max.), 180 R.P.M.
Maker:—*Allis Chalmer.*

Main Generator:
4—13,750 K.V.A., 80% P.F., 6,600V., 3 phase. 60 cycle.
Maker:—*General Electric.*

Transformer:
9—9,200 K.V.A., 6,600/89,000V., delta-star non-grounded. (3-spare).
Maker:—*Westinghouse.*

Switchboard:
Type:—*Bench type.*
Maker:—*Westinghouse.*

Actual Scene of Coolie Work in constructing Tail-race
at Momoyama Plant

MOMOYAMA POWER STATION

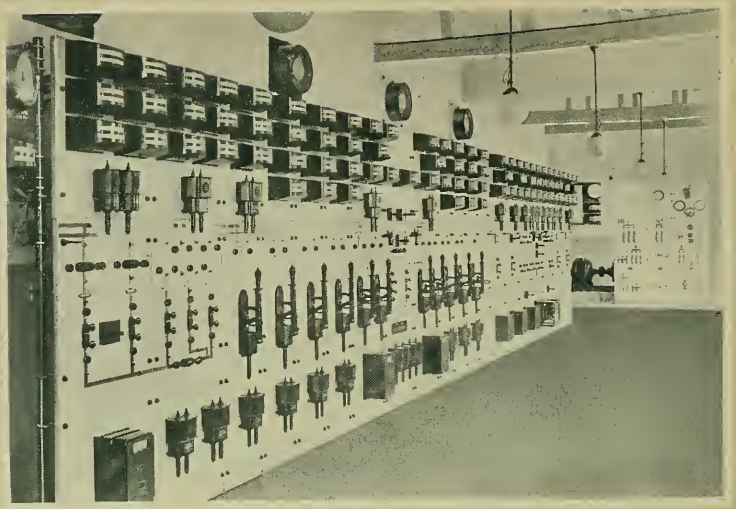
Effective Discharge.	Cub. ft./sec MAX. 1,300 MIN. 639 „
Effective Head.	262 ft.
Theoretical Horse Power.	MAX. 38,000 H.P. MIN. 19,000 „
Out-put in K.W.	MAX. 23,100 K.W. MIN. 11,650 „
Total Length of Water Way.	13,974 „
Length of Tunnel.	13,974 ft.
Work Began.	Dec.—1921
To be Completed.	Dec.—1923.

Main Turbine:
Single spiral, single discharge, vertical type.
2—20,000 H.P. (Max.), 300 R.P.M. or 250 R.P.M.
Maker:—*Escher Wyss.*

Main Generator:
2—15,000 K.V.A., 80% P.F. 6,600V. 3 phase, 60 cycle and 50 cycle.
Maker:—*Westinghouse.*

Transformers:
7—5,000 K.V.A., 6,600/77,000V. delta-delta. (1—spare).
Maker:—*Siemens.*

Switchboard:
Type:—*Bench type.*
Maker:—*Westinghouse.*



Switch Board, Rokugo Sub-station

ROKUGO SUB-STATION

30,000 K.V.A.

Main Transformer : 15—2,500 K.V.A., 60~, P. 72,500V/70,000V/67,500V. S. 11,000V. (3-spare).	Maker :—*Westinghouse.*
Switchboard : Type :—*Panel type.*	Maker :—*Shibaura.*

NISHIKADOHARA POWER STATION

Effective Discharge		Cub. ft./sec MAX. 934 MIN. 471 „
Effective Head		124 ft.
Theoretical Horse Power		MAX. 13,181 H.P. MIN. 6,660 „
Out-put in K.W.		7,200 K.W.
Total Length of Water Way		9,067 ft.
Length of Tunnel		9,067 ft.
Work Began		Oct.—1918
Work Completed		June—1919

Main Turbine :
3—3,700 H.P. (Max.) 514 R.P.M.
Twin Frontal, Francis Turbine.
1 (spare).
Maker :—*Dengyosha.*

Main Generator :
3—2,820 K.V.A., 85% P.F., 6,600V. 3 phase, 60 cycle, 514 R.P.M.
1 (spare).
Maker :—*Shibaura.*

Transformers :
4—3,000 K.V.A., 6,700V, 6,600V, 6,500V,/66,000V.
Single phase, delta-delta.
1 (spare).
Maker :—*Shibaura.*

Switchboard :
Type :—*Panel type.*
Maker :—*Shibaura.*

MIDZUHO SUB-STATION

18,000 K.V.A.

Main Transformer :
7—3,000 K.V.A. 60~, Single-phase.
P. 72,500V./70,000V/67,500V.
S. 11,000V.
(1 Spare)

Maker :—*Shibaura,* (*Indoor type*).
„ *Mitsubishi,* (*Outdoor type*).

Switchboard :
Type :—*Panel type.*

Maker :—*Shibaura.*

TOKITSU SUB-STATION

1,050 K.V.A.

Main Transformer:	Maker:—*Hitachi.*
3—350 K.V.A. 60~, Single phase.	
P. 75,000/72,500/70,000.	
S. 3,500/3,300.	
Switchboard:	Maker:—*Hitachi.*
Type:—*Panel.*	

TŌGŌ SUB-STATION

450 K.V.A.

Main Transformer:	Maker:—*Shibaura.*
3—150 K.V.A. 60~, Single phase.	
P. 64,000/63,000/62,000.	
S. 3,300.	
Switchboard:	Maker:—*Shibaura.*
Type:—*Panel.*	

TAKEFU SUB-STATION

8,100 K.V.A.

Main Transformer:	Maker:—*Shibaura.*
4—2,700 K.V.A. 60~, Single phase.	
P. 64,000/63,000/62,000.	
S. 3,300.	
(1 Spare).	
Switchboard:	Maker:—*Shibaura.*
Type:—*Panel.*	

OSAKA SUB-STATION

141,000 K.V.A.

Main Transformer: Maker: - *Westinghouse.*
18—9,400 K.V.A.
P. 80,800V. S. 31,800V. T. 11,000V.
Single phase.
(3 Spare).

Switchboard: Maker:—*Westinghouse.*
Type:—*Bench type.*

Synchronous Condensers: Maker:—*3. G. E. Co.* *3. Westinghouse*
6—15,000 K.V.A. 11,000V.

SUHARA SUB-STATION

(UNDER CONSTRUCTION)

50,000 K.V.A.

Main Transformer: Maker:—*Westinghouse*
9—8,400 K.V.A. 60~, Single phase.
P. 77,000.
S. 154,000.
(1 Spare).

Switchboard: Maker:—*Westinghouse.*
Type:—*Bench Board*

SANGO SUB-STATION

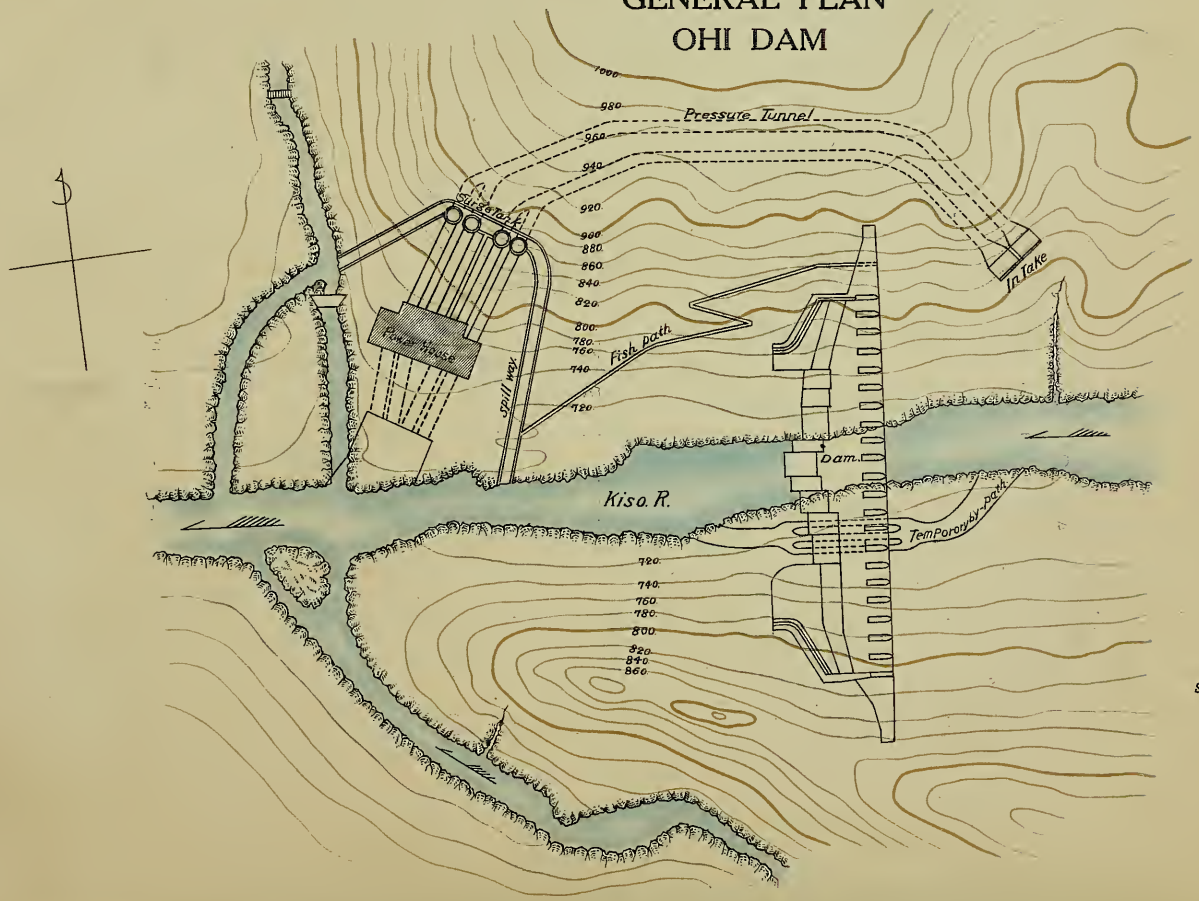
(UNDER CONSTRUCTION)

15,000 K.V.A.

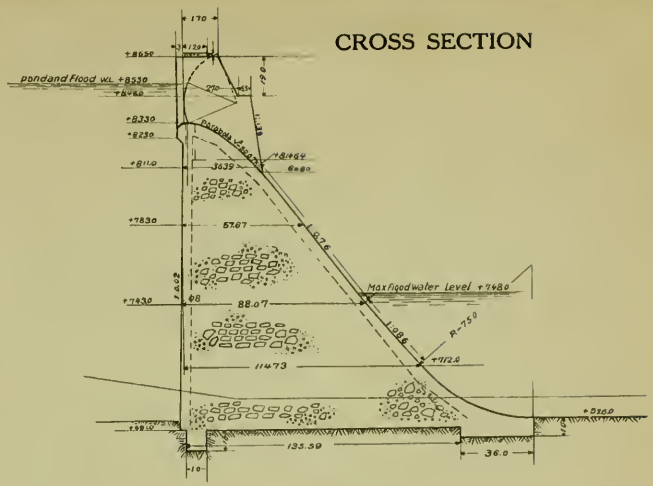
Main Transformer: Maker:—*Mitsubishi*
4—5,000 K.V.A. Single phase.
P. 55,000V/53,000V.
S. 22,000V/11,000V.
(1 Spare).

Switchboard: Maker:—*Inouye.*
Type:—*Panel type.*

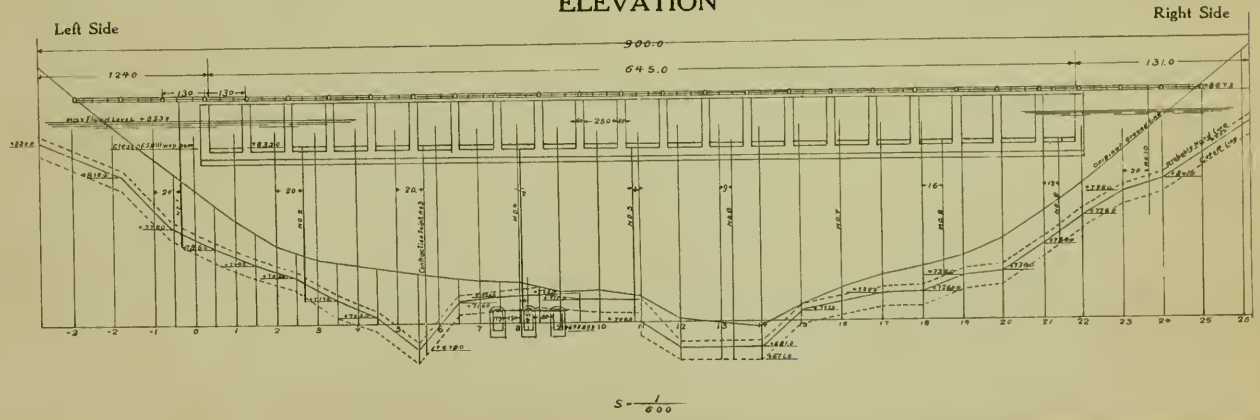
GENERAL PLAN
OHI DAM



CROSS SECTION



ELEVATION



Concrete Mixing Plant for Dam Construction, Ohi Power Plant

Part of Intake under Construction, Yomikaki Plant. In the background is shown Ōkuwa Power House, and at the Upper Right Hand, the Mountain Range of which Mt. Koma is the Highest Peak

Distant View of Mt. Koma seen from Yomikaki. In the foreground is shown the Kiso Cross Forest Railroad

GENERAL VIEW OF THE YOMIKAKI POWER STATION
DAIDO ELECTRIC POWER CO., LTD.

Generator :—

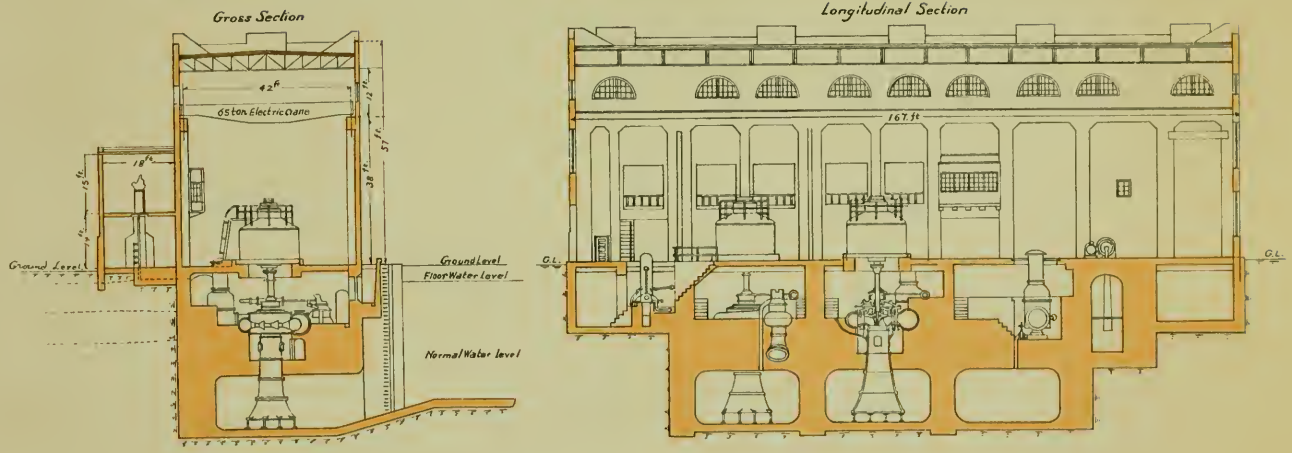
Capacity	17,000 K.V.A.
No. of Units	3
Terminal Voltage	6,600^{V}.

Exciter :—

Capacity	460 K.W.
No. of Units	2
Terminal Voltage	250^{V}.

Out-door Type Transformer :—

Capacity	8 500 K.V.A. (Single phase)
No. of Units	9
Voltage	6,600/154,000^{V}.



GENERAL VIEW OF THE OHI POWER STATION
DAIDO ELECTRIC POWER CO., LTD.

Generator :—

Capacity	13,750 K.V.A.
No. of Units	4
Terminal Voltage	6,600v.

Exciter :—

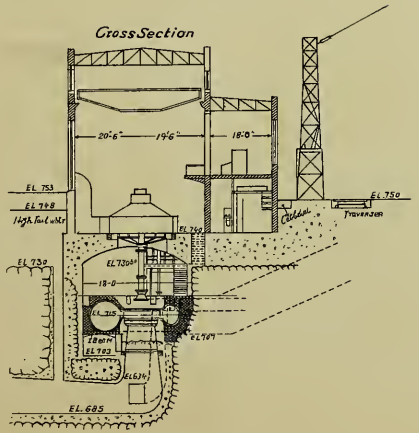
Capacity	675 K.W.
No. of Units.	2
Terminal Voltage	250v.

General Electric

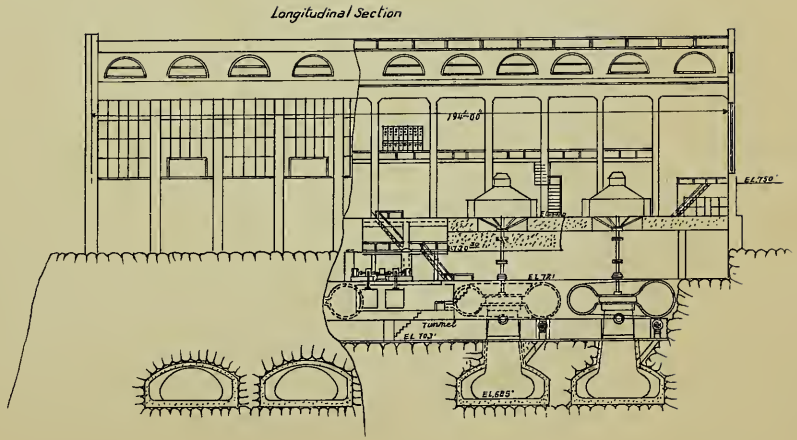
Out-door Type Transformer :—

Capacity	9,200 K.V.A. (Single phase)
No. of Units	9
Voltage	6,600/154,000v.

Cross Section



Longitudinal Section



GENERAL VIEW OF THE MOMOYAMA POWER STATION
DAIDO ELECTRIC POWER CO., LTD.

Water turbine :—

Head	81M
Output	17,000—19,800 H.P.
Speed	250—300v. P.M.
Meker	Escher Wyss

Generator :—

Capacity	15,000 K.V.A.
No. of units	2
Terminal Voltage	6,600v.
Speed	250—300v. P.M.
Frequency	50—60~
Connection	Inter Connected Star
Maker	Westinghouse

Exciter :—

	(Direct Coupled)	(Motor)
Capacity	320 K.W.	330 K.W.
No. of Units	2	1
Terminal Voltage	250v.	250v.
Maker	Westinghouse	Westinghouse

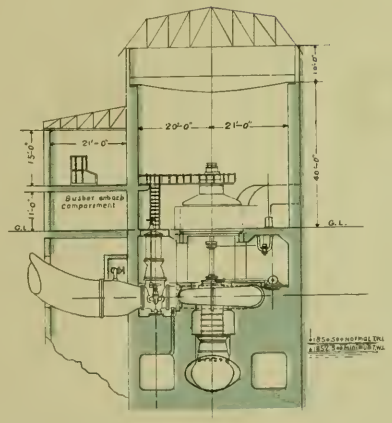
Motor :—

Capacity	480 H.P.
No. of Units	1
Voltage	6,600
Frequency	50—60~
Maker	Westinghouse

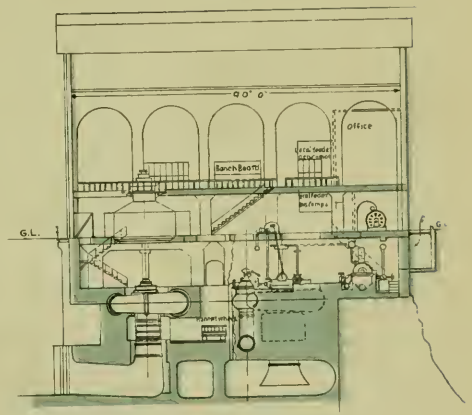
Outdoor Type Transformer :—

Capacity	5,000 K.V.A.
No. of Units	7
Voltage	6,600/7,7000
Frequency	50—60~
Maker	Siemens Schukert

Cross Section



Longitudinal Section



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